Executive Summary

ES.1 Program Overview

In today's dynamic global environment, U.S. military operations comprise elements of all four Services. A military operation is normally accomplished by: establishing a Joint Force, assigning a mission or objective to a Commander Joint Task Force (CJTF), assigning or attaching appropriate forces to the Joint Force, and empowering the CJTF with sufficient authority to accomplish the assigned mission. The CJTF must integrate disparate operational elements and their underlying infrastructures to form a cohesive organization. The Joint Task Force (JTF) staff uses a warning order, operational plans, and experience learned from previous JTFs to guide this effort. Each JTF is rapidly formed and unique, and the CJTF does not have a consistent process or systematic means to assess a Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) architecture prior to employment.

The Joint Methodology to Assess C4ISR Architecture (JMACA) Joint Test & Evaluation (JT&E) provides the CJTF with a validated set of tools and procedures to rapidly assess a JTF C4ISR architecture prior to employment. Early detection and correction of C4ISR deficiencies enhances interoperability and ultimately contributes towards increased Information Superiority. The JMACA Methodology (JM) uses a five-step approach (Figure ES-1). The steps are: Data Mining, Risk Assessment, Fine-Grain Analysis, End-to-End Testing, and Operational Analysis. The end result of the five-step process is recommended enhancements to the JTF architecture. This JT&E program addresses the following problem: The CJTF has insufficient means to rapidly identify deficiencies and solutions within the C4ISR architecture.

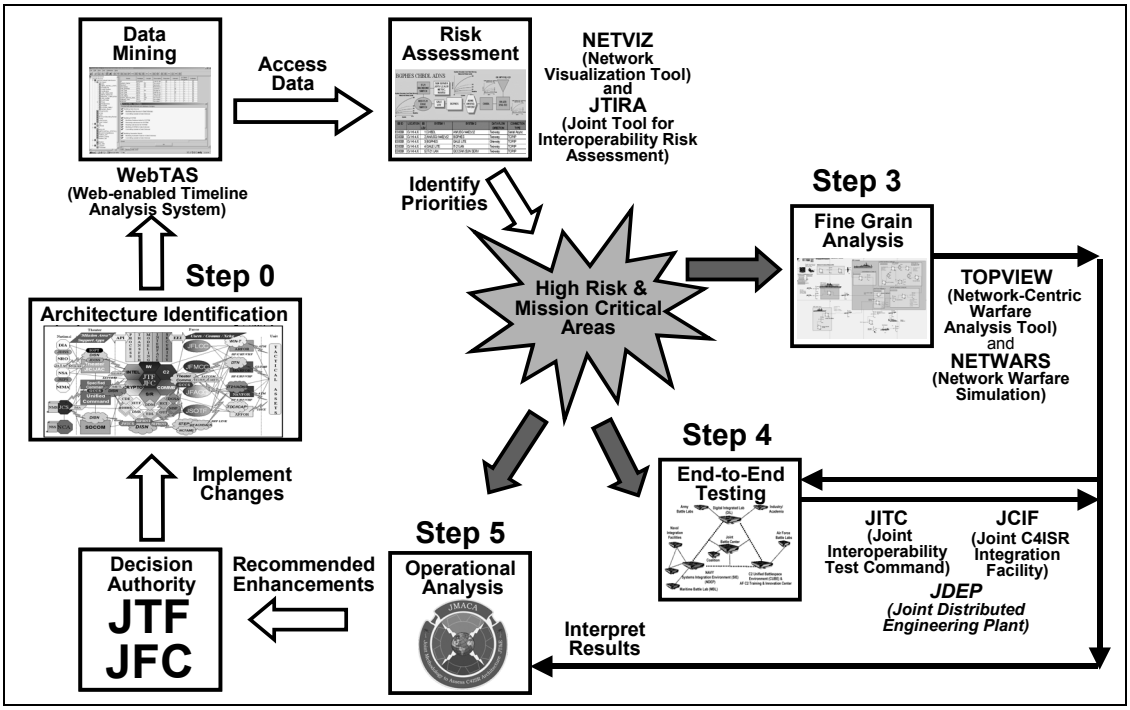

Figure ES-1 JMACA Methodology (JM) Step by Step

A series of JMACA test events are scheduled over the next two years to develop and refine the JMACA process. The first major event in the JMACA JT&E schedule was a Mini-Test. The JMACA JT&E test team conducted the JMACA Mini-Test from 02 to 13 December 2002. As stated in the *JMACA JT&E Mini-Test Detailed Test Plan* (DTP), November 26, 2002, the primary objectives of the Mini-Test were:

- Test rehearsal of Steps 0-3 of the JM using a mission-specific JTF C4ISR architecture.
- Test rehearsal of Step 4 of the JM.
- Distributed testbed connectivity demonstration. Test design, configuration, and execution performed collaboratively between multiple supporting testbed facilities.
- Functional thread testing rehearsal (including instrumentation and data collection). Evaluate and refine, as necessary, the JMACA JT&E test data collection techniques and methods. Specific areas to be addressed include:
  a) Manual data collection techniques
  b) Automated collection techniques
  c) Accuracy of collected data
  d) Sufficiency of collected data

The JMACA JT&E Mini-Test consisted of two independent events over a two week period:

Week 1: JMACA Methodology (JM) Component Testing: (02-06 December 2002, JMACA JT&E Tools Lab, Suffolk, VA)

- The JM toolset was evaluated by the JMACA test team by employing sequential steps of the JM to evaluate a Joint Task Force (JTF) architecture scaled to a Combat Search and Rescue (CSAR) scenario. This was demonstrated in the Architecture Identification (Step 0), Data Mining (Step 1), Risk Assessment (Step 2), and Fine-Grain Analysis (Step 3) steps of the JM.

Week 2: Testbed Environment Testing: (09-13 December 2002, Space and Naval Warfare Systems Command System Center Charleston (SPAWARSYSCEN Charleston); Communications Electronics Command (CECOM), Fort Mommouth, NJ; and the Electronic Systems Center (ESC), Hanscom AFB, MA)

- During Week 2, a demonstration of a distributed testbed was exercised using five notional connectivity capabilities of the selected testbed venues to perform the End-to-End Testing (Step 4) of the JM. An additional testbed connectivity excursion was conducted between Tactical Training Group, Atlantic (TTGL) and CECOM on 09 January 2003.

ES.2 Findings

ES.2.1 Week 1 Findings

All primary Mini-Test objectives for Steps 0 through 3 of the JM were evaluated and met. The capabilities of each tool were assessed within their limitations and constraints, and opportunities for enhancements were identified and are being implemented.

The Mini-Test provided an assessment of the tools' individual capabilities and functionalities – a proof of principal. The entire JM process was not exercised in a truly "progressive" manner (i.e., data used during Steps 0-3 was not used to feed Step 4 of the JM) so a comprehensive assessment of the JM in its entirety was not possible at that time. All indications, however, forecast that the assessment tools evaluated will perform as expected in the framework of a fully functional JM. The current JM toolset will continue to be integrated and refined as planned. An ongoing review of alternate, additional, or emerging analytical tools will continue throughout the life of the JMACA JT&E.

ES.2.2 Week 2 Findings

All primary Mini-Test objectives for Step 4 and distributed testbed testing were evaluated and met. A total of five separate equipment strings were tested via Integrated Services Digital Network (ISDN) connectivity with SPAWARSYSCEN Charleston and CECOM on three equipment strings, and between SPAWARSYSCEN Charleston and ESC on two equipment strings. The Multi-Function Data Collector

(MFDC), a non-intrusive network monitoring and data collection tool, was successfully employed at each of the four testbed facilities.

ES.3 Lessons Learned

ES.3.1 Week 1 Lessons Learned

Early in Week 1, it became apparent that more training and rehearsals with the various JM tools were needed. Skill-level requirements for of some the tools necessitate that users become more proficient prior to the test trials. Thus, more hands-on training will be incorporated into the schedule prior to the execution of Validation Test 1 (VT-1). This is particularly important as tool enhancements are delivered to the test team. Tool immaturity also hampered a thorough assessment of the tools.

The data collection process also yielded some unexpected benefits. Ways to improve the JM data collection process and JMACA data management library were identified and implemented. Lastly, data collectors, as well, must rehearse the process prior to execution.

ES.3.2 Week 2 Lessons Learned

A significant amount of time is required for planning and coordination of End-to-End Testing in a distributed environment. If distributed testing is to be implemented, more precise advance planning, coordination, and communication are essential. Equipment, timing, and availability issues all need to be worked out well in advance during scheduling. Troubleshooting was hampered by lack of coordination, communication, and management between testbeds. Formal configuration management procedures must be in place in each testbed.

Testbed personnel need to be more familiar with capabilities and limitations of other Services' testbeds. Processes and procedures are significantly different between the testbeds. A communications system engineer would have been beneficial to verify interfaces between the systems, including site-to-site interfaces. Participating organizations would have benefited from advanced testing of the configuration and learning more about the capabilities and limitations of the other Services' testbeds. As the detailed plan for VT-1 is prepared, more lead-time will be incorporated into the schedule for advanced planning and preparation.

An enormous amount of time, planning, and coordination was necessary to conduct the End-to-End Testing for the Mini-Test in a distributed environment. Analysis from the testbed participant surveys indicates that the three months of pre-planning was not sufficient to conduct efficient End-to-End Testing. This fact does not fit in with the JMACA JT&E requirement to "rapidly" assess a C4ISR architecture. Time requirements, time restrictions, equipment limitations at the testbeds, and the requirement for close coordination between the testbeds suggests a need to conduct testing and evaluation at a single test site that has the required equipment and functionality; test and test control procedures in place; and the flexibility to respond rapidly to changing JTF situations.

ES.4 Major Findings and Actions for JMACA JT&E

There were several findings made during the conduct of the Mini-Test. These findings, together with the lessons learned, resulted in 25 recommendations to improve the JM toolset, improve Service testbeds for support of Joint testing, and improve the JMACA JT&E test procedures. The major findings and recommendations of the MT are summarized below together with the actions being undertaken by the JMACA JT&E to implement improvements in preparation for the next JMACA test event (VT-1).

ES.4.1 Finding and Action 1

FINDING 1: Increase user training and subsequent practice time on the components of the JM toolset.

ACTION 1: The JMACA JT&E has revamped milestones to increase the formal classroom user training and ad hoc training given to the JMACA test team. Dedicated instruction and usage on the JM toolset in a lab environment has been incorporated into the JMACA schedule.

ES.4.2 Finding and Action 2

FINDING 2: Notify the custodians of each JM toolset component and provide them with user comments and recommendations for software improvements and Human Computer Interface (HCI) refinements.

ACTION 2: The JMACA JT&E has provided the custodians of each tool analyzed during the Mini-Test with the applicable user comments and recommended refinements. Each custodian provides a weekly report to the JMACA JT&E detailing refinement and update status.

ES.4.3 Finding and Action 3

FINDING 3: Improve communication and increase lead-time for future efforts involving distributed testbeds.

ACTION 3: The JMACA JT&E has revised the planning process for future test events, allowing for increased planning and coordination. Additionally, the Detailed Test Plans (DTPs) for VT-1 and VT-2 are being expanded to ensure more effective configuration control, communication, and execution.

ES.4.4 Finding and Action 4

FINDING 4: Reevaluate the role of distributed testing in the JM.

ACTION 4: Shortly after the Mini-Test, the JMACA JT&E began to investigate the merits of utilizing a single test facility, which possesses a majority of equipment currently employed, to perform integrated testing. This method of End-to-End Testing can eliminate several of the obstacles of connecting diverse and multi-service testbeds that the JMACA test team encountered during the Mini-Test. To this end, a Joint Interoperability Test Center (JITC) Capabilities Demonstration is scheduled for 28-30 April 2003. This event will evaluate the capability of JITC to conduct End–to-End Testing of selected equipment strings in a timely manner at a single site. The results of this demonstration will be compared to the End-to-End Testing experiences from the JMACA JT&E Mini-Test to determine the optimum End-to-End Testing protocol that the JM will ultimately employ.

ES.4.5 Finding and Action 5

FINDING 5: Provide additional test and data collection training to the JMACA test team.

ACTION 5: The JMACA JT&E has revamped milestones to increase both formal and informal data collection training. Additionally, the JMACA test team will observe test and data collection procedures during non-JMACA JT&E tests and exercises to develop resident expertise.

ES.5 Conclusion

The JMACA JT&E Mini-Test successfully met all of the primary objectives as specified in the JMACA Mini-Test DTP. The results of the Mini-Test clearly indicate that the JMACA Methodology continues to be logical, feasible, and, most importantly, executable. The JMACA test team has drawn heavily from the results and lessons learned from the Mini-Test in order to ensure successful preparation and execution of the upcoming JMACA test events. The following are the major conclusions found during the Mini-Test:

- Some of the JM tools require enhancements which are being coordinated with the tool custodians.
- The use of service-specific testbeds in a distributed environment does not currently support the JM "rapid" criteria.

The JMACA JT&E test team is implementing all lessons learned and following through on necessary actions to ensure the JM will be fully mature and the JMACA test team will be ready for VT-1.